DEMOGRAPHIC INFLUENCES ON CONSTRUCTION CRAFT SHORTAGES IN THE U.S. AND CANADA

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Abstract: The United States and Canadian construction markets are facing a shortfall of skilled craft workers in the face of increasing labor demands. There are initial indications that the shortages are already having a significant impact on project performance in the industrial construction sectors. While there are many demographic aspects of the shortage, the authors focus on the shift in aging of the United States and Canadian construction workforce and the effects this is having on the availability of craft workers, especially on highly skilled craft trades such as pipefitters and electricians. Also, the authors examine immigration policy and its influence on the qualifications of the construction workforce. The authors use multiple US and Canadian data sources to examine the trends on both sides of the border, including the US Bureau of Labor Statistics’ Current Population Survey, Statistic Canada, and the Build Force Canada datasets. The findings show that while both the US and Canadian construction markets are experiencing an aging workforce, the aging of the US workforce is occurring at a much faster rate.

1 INTRODUCTION

Construction is one of the largest economic industries in the United States and Canada. In 2010, construction accounted for 3.5% of the U.S.’s Gross Domestic Product (GDP) (CPWR 2013), and for 6% of Canada’s Gross Domestic Product (GDP) (Statistic Canada 2014). Construction in 2012 employed approximately 9 million workers in the United States (Dong et al. 2014), whereas Canada employed 1.3 million (Statistics Canada 2014).

The Bureau of Labor Statistics (BLS) estimates that the US construction industry will be the fastest growing industry over the next decade, which will create an estimated 1.6 million jobs (Glavin 2013; Gonzales 2013). The growth of construction projects will increase the demand for skilled craft workers, (Wilder 2013; Shelar 2013). Industrial construction on the Gulf Coast has contributed 1,100 projects and $44 billion in revenue, effectively increasing hours worked from 99.7 million to a projection of more than 121 million by 2016. Likewise, Canada has a vast number of oil and gas projects that are on an upward trend (Wilder 2013), although the authors note current dramatic fluctuations in oil prices will likely significantly temper the demand for workers. According to the Construction Sector Council of Canada, the Canadian construction industry will need 319,000 new workers to replace retiring workers and to also fill new job openings—219,000 and 100,000 respectively between 2012 and 2020. The Construction Sector Council estimated that graduates of vocational schools could fill almost half of these jobs, but the other industries like manufacturing and migrant workers will have to fill the remaining jobs (Komarnicki 2012).
Because of the high demands for construction, companies are losing money from the lack of skilled craft workers. According to Stephen E. Sandherr, the Associated General Contractor's (AGC) Chief Executive Officer, 74% of construction companies in the U.S. are having difficulties finding workers to fill job openings (Gonzales 2013)—specifically in the Gulf Coast region (Wilder 2013). The Bank of Canada's Business Outlook Survey in 2012 claimed that 29% of Canadian firms face labor shortages, an increase from 2009 and 2010 (Komarnicki 2012).

The skill shortages in the construction industry are not new, and are a cyclic problem (Castaneda et. al. 2005). A shortage of skilled, qualified craft professionals has been an unfortunate recurring trend in the US and Canadian construction industries for the past three decades. In the early 1980's, the Business Roundtable predicted that a shortage of skilled craft workers would hamper the growth of both open shop and union construction sectors by the late 1980s (BRT 1983). The prediction was confirmed by a 1996 Business Roundtable study that found that 60% of its surveyed members were experiencing a shortage of skilled craft workers; 75% of the respondents indicated that the shortage had worsened in the five years prior to the study (BRT 1997). The shortage of craft workers apparently has further worsened in recent years. In 2001, the Construction Users Roundtable (CURT) conducted a survey in which 82% of the respondents reported shortages on their projects. In addition, 78% of the same respondents indicated that the shortage had worsened in the three years prior to the study (CURT 2001). In 2007, that number had risen to 86% (Sawyer and Rubin 2007).

Higher skilled trades in construction (e.g. electricians and pipefitters) are experiencing greater shortages in comparison to lower skilled trades (e.g. laborers and roofers). Electricians, pipefitters, welders, boilermakers, millwrights, and ironworkers are among the skilled crafts with the greatest demands among construction industry trades in the U.S. (Wilder 2013; Shelar 2013; Gonzales 2013). Yet electricians will be the trade in demand in Canada between 2011 and 2020, as predicted by the Canadian Occupational Projection System (COPS). While COPS believes there will be a higher demand for electricians, this timeframe could also experience a surplus of carpenters, plumbers, pipefitters, and gasfitters. Nevertheless, a surplus in some regions may hide skill shortages in other regions (Komarnicki 2012).

1.1 Reasons for the Shortage

Many agree that the skills shortage issue is multifaceted (Watson 2007; Healy et. al. 2011). Two reasons for long-term shortages are a lack of training and an inability to attract new talent. There are also reasons for short-term shortages, such as an increasing demand within the workforce and the retirement of the Baby Boomer generation of workers (born between 1946 and 1965). A significant reason for the craft worker shortage is the aging, “greyring,” population. In 2010, 39% (3.5 million) of the U.S. construction workforce were Baby Boomers, many of whom had already reached the normal retirement age which varies from age 65 to age 67 (SSB 2014; GOC 2014b; CPWR 2013). Just a decade earlier, 49% of the construction workforce were Baby Boomers (4.6 million) (CPWR 2007). The average age of the U.S. construction workers was 40.2 years in 2010. In comparison, union workers are on average five years older than non-union workers. In 2010, union workers average age was 42.4 years and non-union workers average age was 37.7 years (CPWR 2013). Shigeru Fujita (2014), believes the Baby Boomers’ retirement is a main contributor to the workforce shortage, which started around 2010 and became much more problematic at the beginning of 2012. However, 30 % of the total decline in the participation rate, which was measured from the beginning of the great recession up to the end of 2011, is due to discounted workers, who stop looking for employment. R.E. Parker, president of Repcon, Inc., a mechanical contractor based in Corpus Christi, Texas said “Due to the aging of the ‘baby-boomer’ workforce and the tremendous amount of construction planned for the next several years, our current labor shortages are going to become a crisis” (Wilder 2013). However, the major contributor to the construction workforce shortages as a result of baby boomer retirements is a continuance of two actions within the workforce during the last couple of decades. First, more and more existing workers have been leaving the construction industry for other industries, especially during the great recession. Second, there has been a lack of new workers entering the construction industry (Druker and White, 1996). While the current rapid decline in oil prices has diminished the demand for oil service projects, especially in the upstream, it is also having a positive effect of increasing craft demand for construction projects in other
sectors designed to take advantage of cheap energy prices, such as projects related to manufacturing. Table 1 is a list of reasons of construction workforce shortages from previous studies.

Table 1: Reason for Construction Workforce Shortages from Previous Studies

<table>
<thead>
<tr>
<th>Reason of Construction Workforce Shortages</th>
<th>Reference (Previous Studies)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aging of the workforce</td>
<td>Watson 2007; Komamicki 2012; Gonzales 2013; Wilder 2013; Fujita 2014</td>
</tr>
<tr>
<td>Increase the demand of craft workers</td>
<td>Watson 2007; Healy et. al. 2011; Shah and Burke 2005; Haskel and Martin 1993; Komamicki 2012; Glavin 2013; Wilder 2013; Shelar 2013</td>
</tr>
<tr>
<td>Changing in skill requirements (i.e. new technology)</td>
<td>Watson 2007; Haskel and Martin 1993</td>
</tr>
<tr>
<td>Poor education/Poor training</td>
<td>Watson 2007; Healy et. al. 2011; Haskel and Martin 1993; Castaneda et. al. 2005</td>
</tr>
<tr>
<td>Not meeting the employer expectation</td>
<td>Watson 2007</td>
</tr>
<tr>
<td>Poor market information</td>
<td>Shah and Burke 2005</td>
</tr>
<tr>
<td>Decrease the number of the new entrants</td>
<td>Druker and White 1996</td>
</tr>
<tr>
<td>Poor wages</td>
<td>Watson 2007; Shah and Burke 2005; Haskel and Martin 1993; Castaneda et. al. 2005; Healy et. al. 2011; CII 2000</td>
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<tr>
<td>Poor industry image</td>
<td>Shah and Burke 2005; Castaneda et. al. 2005</td>
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<tr>
<td>Poor working condition</td>
<td>Shah and Burke 2005; Castaneda et. al. 2005; CII 2000</td>
</tr>
<tr>
<td>Geographic location of business/job</td>
<td>Healy et. al. 2011; Shah and Burke 2005</td>
</tr>
<tr>
<td>Lack of job security/Poor treatment/Poor safety</td>
<td>CII 2000</td>
</tr>
<tr>
<td>Lack of a worker-oriented career path</td>
<td>Castaneda et. al. 2005</td>
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1.2 Research Objectives

The main objective of this study is to understand the influence of demographics on the construction industry's workforce availability, focusing on the shift in aging of the United States and Canada. In addition, the study examines the influence of immigration policy on the educational attainment of construction craft in both the U.S. and Canada.

2 RESEARCH METHODOLOGY

The authors use multiple US and Canadian data sources to examine the trends on both sides of the border, including the US Bureau of Labor Statistics' Current Population Survey (CPS), Statistic Canada, and the Build Force Canada datasets. This study includes only craft workers in the construction industry, filtering out manager, superintendents, foreman workers, inspectors, and engineers.

3 RESULTS OF ANALYSIS

3.1 Average Age

3.2 Construction Industries vs. All Other Industries [United States]
An increase in the average age of construction craft workers is one of the reasons for the shortages. Craft workers in the construction industry are younger than craft workers in all other industries. From 1994 to 2006, the aging rate for the construction industry was 0.092 and the aging rate for all other industries was 0.260, Figure 1. However, the aging rate for the construction industry has increased almost four times (4.4 times) from 2007 to 2014 and became 0.405, while the aging rate for all other industries has decreased by 0.7 times to become 0.185. Yet, the average age for all industries is older than the average age for construction industry. In 2014, the average age for all industries is 42.9 while the average age for construction industry is 40.8.

3.2.1 Average Age at Trades Level [United States]

The authors observed the average age among four high skilled trades, including carpenters, electricians, pipelayers-plumbers-pipefitters-steamfitters, and construction equipment operators [except crane], Figure 2. In general, the average age in each these trades is above the average in all skilled trades in construction. The equipment operators’ trade has older workers than other trades, and the carpenters' trade age has increased sharply since 2006.

3.2.2 Construction Industry's Average Age [United States vs. Canada]

The writers compared the U.S. construction industry's average age with the Canadian construction industry's average age. The Canadian dataset is relatively limited in that it did not go back earlier than the year 2006. In 2006, the average age in Canada was 39.5 and in the U.S. it was 37.4. However, the U.S. working age increased in 2014 to 40.8 years on average, while the Canadian average age for construction workers stayed almost the same, at 39.8 years, Figure 3. Therefore, the overall outcome summary from this analysis is that the US construction industry is aging at an alarmingly rate, which puts it at risk, especially during the current high demand period.

3.2.3 Age Distribution

The writers examined the age distribution in 2007, just before the great recession, and compared it with the age distribution in 2013. For all craft workers, the average age in 2007 was 37.4 and in 2013 it increased to 41. As shown in Figure 4, the percentage of young workers in 2007 was higher than the
percentage in 2013, but the percentage of the workers who were 70 years old or older was almost the same at years 2007 and 2013. Therefore, the construction industry lost more craft workers than it gained over this six year period. On the other hand, the authors used Statistics Canada to observe the age distribution for the Canadian side. Instead of including each worker’s raw age, Statistics Canada reports data on age classified by groups. In order to examine the age distribution on a similar time scale, the probability distribution for Canadian construction workers was examined for 2006 and 2011, Figure 5. In 2006, the first mode was the age group from 20 to 24 years, and the second mode was the age group from 40 to 44 years. And in 2011, the first mode was the age group from 25 to 29 years, and the second mode was the age group from 20 to 24 years. Therefore, the Canadian construction workers in 2011 were younger than construction workers in 2006.

In a further detailed analyses, the authors examined the age distribution for the electricians and pipelayers-plumbers-pipefitters-steamfitters trades in the U.S., since they represent the industrial construction trades that are currently in high demand. For US electricians, the average age in 2007 was 38.7 and in 2013 it increased to 41.4. As shown in Figure 6, the percentage of young workers in 2007 was higher than the percentage in 2013. However, the percentage of the workers who were 70 years old and older was higher in 2007 than 2013. Therefore over this time frame, the U.S. construction industry lost more electricians than the average loss of all craft workers. For the pipelayers-plumbers-pipefitters-steamfitters trade, the average age in 2007 was 39.7, and it increased to 41.5 in 2013. As shown in Figure 7, the percentage of young workers in 2007 was higher than the percentage in 2013. However, the percentage of the workers who were 70 years old and older was almost the same at years 2007 and 2013.
3.3 Immigration

There are other differences between the Canadian and the U.S. construction workforces. For example, the majority of white workers in the United States are U.S. citizens, while a large number of the white workers in Canada are not Canadian citizens, but rather from Europe and the U.S. However, the Canadian government utilizes a Temporary Foreign Worker Program (TFWP) that “allows Canadian employers to hire foreign nationals to fill temporary labor and skill shortages when qualified Canadian citizens or permanent residents are not available” (GOC 2014a). The workers in this program have flexibility to become permanent residents if their skills are needed (GOC 2014a). The U.S. H-2B Visa, which is equivalent to Canadian TFWP program, is not flexible (Wilson 2013). Therefore, the authors looked at the immigration in the both countries differently. In Canada, the authors looked at the workforce population by their citizenship (Canadian by birth, Canadian by naturalization, and not a Canadian citizen) to study immigration, which is equal to the “not a Canadian citizen” category. In the U.S., the authors focused only on the Hispanic population, since this has been a historically faster growing demographic population in the U.S. construction industry, while other populations have been shrinking (Goodrum 2004).

3.3.1 Canadian Citizenship [Construction vs. All Other Industries]

The authors examined the Canadian construction workforce by their citizenship. Almost 80% of craft workers are Canadian by birth. In 2011, the percentage of the workers who were not a Canadian citizen was almost similar in construction and all other industries with the rate of 4.5%, Figure 8. However, the construction industry has a lower percentage of Canadian citizens by naturalization. In 2011, the percentage of naturalized citizens in the construction industry was 11.13%, while the percentage in all other industries was 15.6%.

3.3.2 High School Graduates or Higher in Construction Industry [By Canadian Citizenship]

The writers took an additional step and observed the educational level of Canadian construction craft workers by citizenship. The educational level varies by citizenship type for the year 2001 and years before, Figure 9. In 1991, the percentage of construction workers who had at least a high school diploma was 55.9% for those who were “Not a Canadian citizen”; 59.9% for those who were “Canadian by naturalization”; and 63.3% for those who were “Canadian by birth”. However, the rate of high school graduates increased for all citizen types. In 2011, the craft workers who had at least a high school diploma were around 80% for both citizens and non-citizens, which is in many ways in stark contrast to the high school graduation rates among Hispanic and non-Hispanic construction workers in the U.S. (Figure 13).
One of apparent influences of the increasing educational level of foreign workers in Canada was the weight applied to an immigrant's educational attainment through the old immigration entry system. The education category constituted around 25% of the old weighting system. The Canadian government focused more on educated (talented) foreign workers, Figure 10. However, the weighting system changed in 2015 to an express entry system, which places significantly more weight on having a job offer (50%), and decreases the weight related to educational attainment to only 10%. The influence of the new weighting system on the educational attainment among immigrant workers in the Canadian construction industry is yet to be seen.

3.3.3 Hispanic Workforce in the United States [Construction vs. All Other Industries]

The authors also looked at the rate of Hispanic employment in the U.S. and found that the rate has grown significantly over time for construction and all other industries, Figure 11. However, the Hispanic population rate was lower for the construction industry in the mid-90s, and it has grown very fast since the beginning of 2000s. In 2014, the Hispanic population rate was 26.9% in the construction industry, and 17.4% in all other industries, while it was 9.9% in 1994, in both construction and all other industries.

3.3.4 U.S. Construction Hispanic workers at Trades Level

The writers examined the employment rate of the Hispanic population among specific U.S. construction trades. The highest employment rates of Hispanic workers within specific construction trades were typically related to the residential sector, Figure 12. In fact, most of these trades did not require an education background (high school degree or higher) (BLS 2014). Less than 20% of Hispanic workers were in higher skilled trades (which are below the all craft trade’s average) that require unique training or certification (e.g. electrical and pipefitter).
3.3.5 High School Graduates or Higher in the U.S. Construction Industry [Hispanic vs. Non-Hispanic]

The researchers studied the educational level among U.S. Hispanic craft workers and compared it with non-Hispanic craft workers. The sampled Non-Hispanic workers reported having higher educational levels, measured by high school graduation rates, as compared to the sampled Hispanic workers, with an approximate gap of 37% in 2014, Figure 13. In 1994, 42.1% of Hispanic workers had a high school degree, while 77.4% of non-Hispanic workers had the same degree. In 2014, the rate of educated Hispanic workers increased to 50.3%, while the rate of non-Hispanic educated workers also increased to 87.3%.

4 DISCUSSION

The aging of the workforce indicates that the retirement of baby boomers is having a significant impact on the current workforce shortage. The entire workforce’s average age has increased over the time, but the age of the U.S. construction industry grew very fast in recent years, almost four times faster than in the previous decade. Age distribution results show that the construction industry in the U.S. is losing more workers than it gains, especially electricians and pipefitters. Losing experienced skilled workers will create a gap, since skilled trades require unique training and certification, which for new workers takes time usually measured in years. Therefore, most of the highly skilled trade workers in the U.S., including electricians, and pipefitters, are older than the average craft trade workers in the construction industry. However, the average age of Canadian construction workers was also been growing steadily. However, the average Canadian construction worker in 2014 was still younger than the U.S. construction worker. Moreover, the Canadian age distribution shows that more young workers entered the construction industry in recent years.

It appears that Canadian immigration policy, which has placed a significant weight on an applicant’s educational attainments, has influenced the overall educational level of the Canadian construction workforce. The educational attainment of Canadian foreign-born workers was nearly equal to that of Canadian natural born worker. As part of a growing immigrant workforce in the U.S., the same cannot be said for the U.S. Hispanic construction workforce when compared to the non-Hispanic workforce. A significant educational gap between Hispanic and non-Hispanic construction workers exists in the U.S. This gap limits the abilities of the Hispanic workforce to enter into higher skilled and higher pay construction jobs. In a time when the U.S. construction market is experiencing severe workforce shortages among higher skilled jobs, structural changes in the education and training of the Hispanic workforce is needed.

5 CONCLUSION

Using the previously mentioned data sets (CPS, Statistics Canada, and Build Force Canada), this research primarily examines the influence of demographics on skilled workforce shortages, comparing the U.S. construction industry with Canadian construction industry. Additionally, the authors focused on the trades that are more related to the industrial projects. The following findings were identified:

- There is a “greying” of the workforce, especially in the U.S., and the rate is increasing. All other industries craft workers in the U.S. are older than the construction craft workers. However, in the last decade, the rate of aging among U.S. construction workers is almost four times higher than the growing rate from the previous decade.
• High Skilled trades in the U.S. (i.e. electricians, and pipefitters) are older than the construction industry average age.
• The construction industry in the U.S. is losing more craft workers than it is attracting.
• The Canadian construction foreign workers percentage has not increased over time, but their level of education has increased sharply.
• The percentage of Hispanic craft workers in the U.S. has increased sharply over the time while their level of education has not.

The analysis showed that the aging of the construction workforce plays a significant role in the current craft shortage, especially in the U.S. Outside of revamping a U.S. immigration policy that considers the educational attainment of foreign born workers, the U.S. needs to critically examine how to improve the educational attainment of Hispanic construction workers both for the personal benefit of the individual worker and the industry's needs.

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